Appendix C.
RECOMMENDED
DEVELOPMENT PROCESS

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RECOMMENDED DEVELOPMENT PROCESS

The Commercial Vehicle Information Systems and Networks (CVISN) Guide to Top-Level Design and the CVISN Guide to Project Planning describe fundamental principles and generic processes. This chapter applies and tailors this guidance to the credentials administration area. Some states may already have a well-documented methodology for information system development. If so, the state should follow that process, possibly making some adjustments to incorporate any ideas included here that aren't reflected in the state's standard procedures.

The first section in this chapter provides an overview of the entire process. Subsequent sections address each successive phase of the process, including these topics:
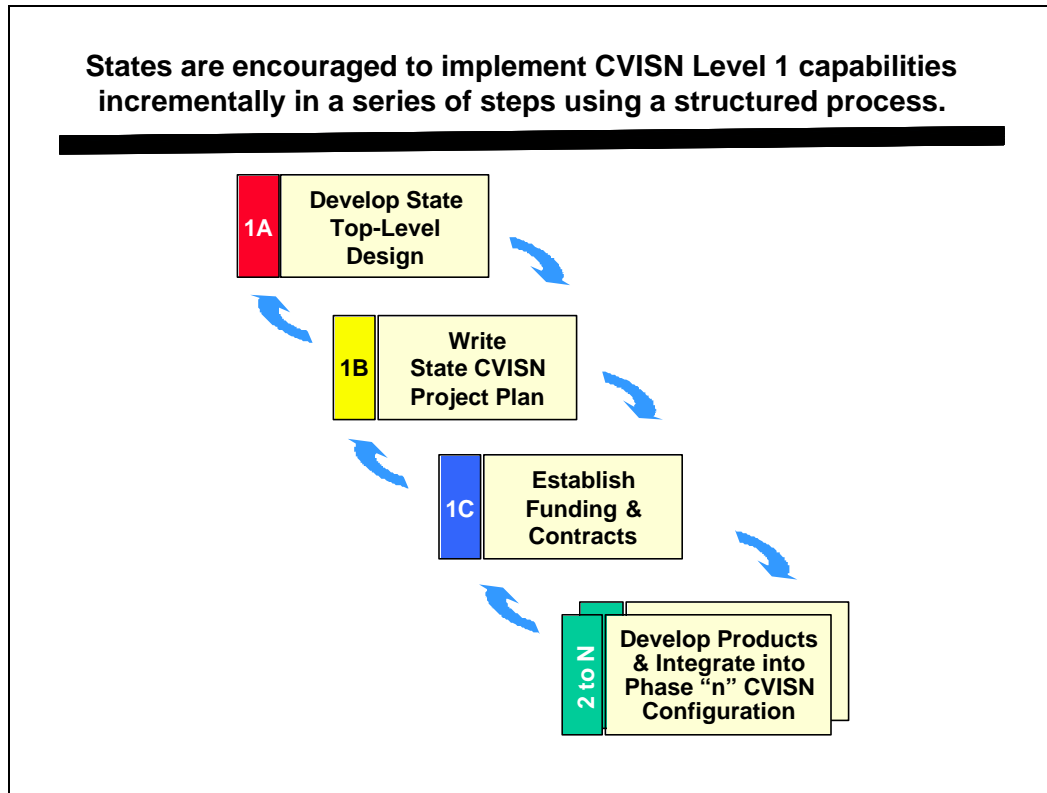
- phase process
- phase products
- factors to consider
- list of key decisions (refer to Chapter 5 for a description of each)
- advice and lessons learned

A final section addresses requirements specification, a topic that impacts all phases.

C.1   Development Process Overview

The *Introductory Guide to CVISN* outlined a model development process for implementing CVISN capabilities. Figure C–1 is repeated from that document as a reminder of the model.

Deploying CVISN Level 1 capabilities is a major undertaking that typically takes several years. In order to reduce risk, it is strongly recommended that states use an incremental deployment approach. It is critical that this large project be broken into a series of 3–6 month time periods called project phases. Specific results or products are defined for each phase. These are defined in detail for each phase just before it begins, and more broadly for subsequent phases. The use of phases allows taking a big job and breaking it into small, manageable pieces. If a state completes the first couple development phases on time and meets all the objectives, this provides assurance that the plan is realistic. If not, it allows the state to revise the plan and take other corrective actions prior to committing extensive resources to a project that is not properly structured for success. Incremental development and measurable milestones ensure stakeholder participation and feedback and real visibility into project progress.

States are encouraged to implement CVISN Level 1 capabilities incrementally in a series of steps using a structured process.

1A	**Develop State Top-Level Design**
1B	**Write State CVISN Project Plan**
1C	**Establish Funding & Contracts**
2 to N	**Develop Products & Integrate into Phase "n" CVISN Configuration**

Figure C–1. Overview of CVISN Deployment Process

The figure shows that the first phase is devoted to developing the state top-level design, preparing the State CVISN Project Plan, establishing full funding for the project, and issuing major contracts for products and technical services. Each subsequent phase is a development phase that results in some type of demonstration or operational capability. More information on phases is provided in the *CVISN Guide to Project Planning* and the *CVISN Guide to Phase Planning and Tracking*.

This Guide to Credentials Administration has been prepared with the experience of early CVISN deployments in mind. It assumes that states will have to do considerable requirements analysis and state-specific planning. As time goes on and CVISN moves into the mainstream, this will be less the case. Some of the aspects of CVISN will become routine. This may be true for your state even now.

For example, if your state uses an existing fuel tax processing system (e.g., the Regional Processing Center (RPC) or the Lockheed Martin IMS VISTA/TS product) and this system has a proven electronic data interchange (EDI) front-end interface to allow electronic credentialing using open standards, you can move quickly through these processes and eliminate some of the detailed requirements analysis. Similarly, if your state uses an International Registration Plan (IRP) product that already has an interface to the IRP Clearinghouse, you should be able to shortcut the process and move to a quick implementation of that capability.

The approach defined herein assumes that your state is providing some level of system integration. If you decide to subcontract the role of system integrator, you may not follow the detailed steps outlined herein. Most likely, your system integrator will propose an approach based on their methodology. Nevertheless, the material herein can help you to understand what they must accomplish.

C.2   Top Level Design Phase

Top-Level Design Phase Process

The CVISN Guide to Top Level Design describes the general process for developing a top-level design. Figure C–2 describing this process is repeated below as a reminder.
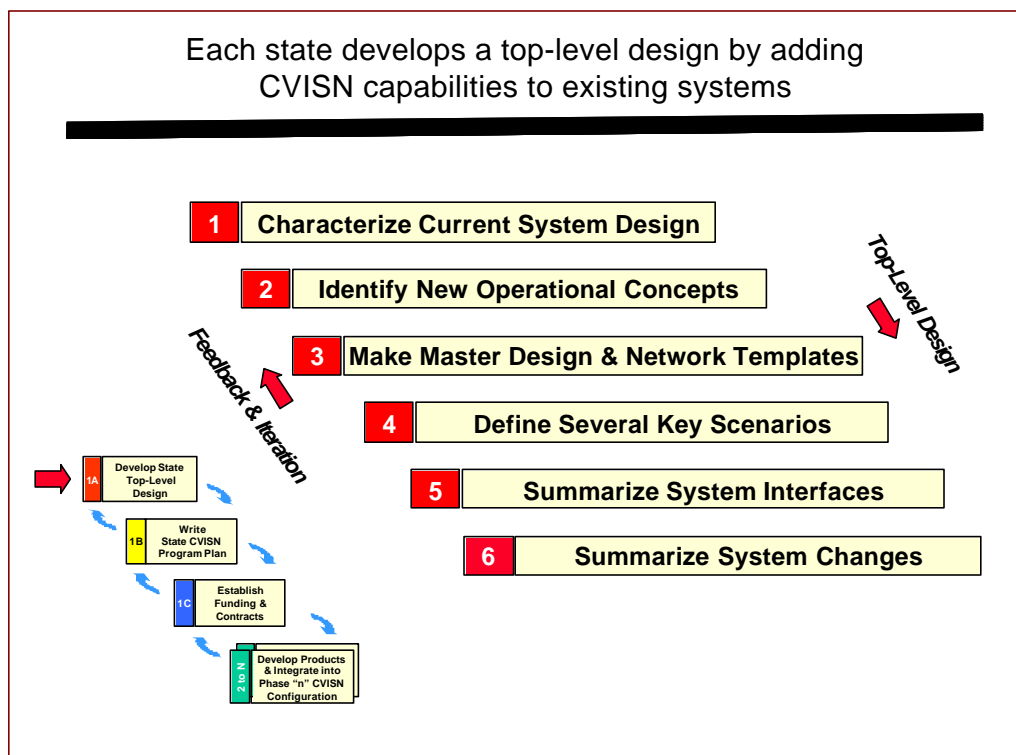
Figure C–2. Top-Level Design Process

Even though the steps are shown as sequential, the process actually involves a great deal of feedback and iteration. Throughout the process, identify issues, actions and decisions. At the end of this process, your state will have decided what products it wants to develop or acquire, what modifications it wants to make to existing systems, and how it wants to interface systems to each other. This phase establishes the technical framework for everything that follows.

Top-Level Design Phase Products

- · A State CVISN Top Level Design Description that shows how credentials administration fits into the statewide CVISN design. It should include:
    - – System Requirements
        - ✓ State-specific goals
        - ✓ CVISN Operational and Architectural Compatibility Handbook (COACH) Part 1 tables from Chapters 2, 3, 4, 5, 6
        - ✓ COACH Part 4 tables
        - ✓ Other state requirements
    - - System Design
        - ✓ Allocation of requirements to system components
            - ➤ COACH Part 3 tables, tailored as needed
            - ➤ Description of functions for each new component
        - ✓ System Interface Summaries
        - ✓ Top-Level Physical System Design
    - - System Change Summary
    - - Operational Scenarios
    - - Issues
- · In addition to the State CVISN Design Description, your state may want to prepare a separate, more detailed Credentials Administration Requirements Specification (CARS) document. This document provides a description of how transactions flow end-to-end through all the systems supporting credentials administration. It also allocates requirements to each subsystem, legacy system interface and legacy modification. (Please see section C.6 for more on requirements specification.)

Factors to Consider in the Top-Level Design Phase

- · The credentials administration area is the most complex of the three CVISN Level 1 capability areas. It involves multiple systems with complex interfaces. Different vendors or state organizations often develop these systems. A single transaction, such as registering a vehicle, may initiate other transactions that thread their way through 5 to 10 systems before the task is accomplished. A Carrier Automated Transaction (CAT) (or fleet management package) or Web site, Credentialing Interface (CI), IRP system, IRP Clearinghouse, state financial system, several bank systems, flags and conditions checks in related state databases, and an interface to Commercial Vehicle Information Exchange Window (CVIEW) (or equivalent) must all work properly for this function to work as a whole.
- · Because of the complexity of the credentials administration area, it is especially important to limit the level of detail in the top-level design. The top-level design should provide a technical framework that allows the various parties involved to proceed with their parts relatively independently. For example, the top-level design can not specify every possible transaction scenario that can occur. But it can describe key scenarios and establish the framework for others. Similarly, it can not specify

precisely every possible error condition that can occur and how to handle it. But it can establish a systematic framework for dealing with errors.
- As part of the system design process, the state needs to deliberately assess the expected transaction volume and what that implies for computer, storage, and networking needs. This assessment should be updated periodically as the project proceeds.

Key Decisions

- For which credentials will the state implement electronic credentialing?
- Are there some parts of a credentials process where automation is impractical or the benefit of automation isn't worth the cost?
- Will the state implement a person-to-computer or a computer-to-computer interface for electronic credentialing? Will the state elect to implement both?
- If the state elects to implement a computer-to-computer interface for carrier-to-sate transactions, what interface method will be used (X12 EDI, XML, or other)?
- For each credential, will the state modify the legacy system (LM) to handle EDI, or translate the incoming transactions in some legacy system interface (LSI) and pass the credential application data to the legacy system in the native form?
- How will requirements be specified?
- How will snapshots be updated to reflect credentials actions?
- Where and how will snapshots be used in the credentialing processes?
- Where will error checks be performed?
- How can the state leverage the automation to help with paper forms processing?

Advice and Lessons Learned

- Develop requirements in multiple levels of detail. Use clear, concise top-level, testable, requirements as the basis for procurements and contracts. Develop more detailed business process descriptions as required by each phase as the work proceeds. (Please see section C.6 Requirements Specification for more discussion.)
- The use of a CI to serve as a single electronic interface from motor carriers to states has proven to be a useful concept. It allows a state to control and standardize its external interface to carriers independently from internal processes. It then preserves the ability to contract to different vendors for IRP, International Fuel Tax Agreement (IFTA), oversize/overweight (OS/OW), intrastate registration, hazardous materials (HazMat), electronic screening enrollment, titling, and carrier registration without impacting the motor carrier community each time a change is made. The state can hide internal changes from motor carriers by developing custom legacy system interfaces (LSIs).
- Survey carrier and service bureau customers to determine whether both a Web site and a computer-to-computer interface are required to support the needs of all segments of the carrier community. If both are warranted, plan for both from the outset.

C.3   Project Planning Phase

Project Planning Phase Process

The CVISN Guide to Project Planning describes the general process for developing a project plan and organizing the project. Figure C–3 that portrays this process is repeated below as a reminder.
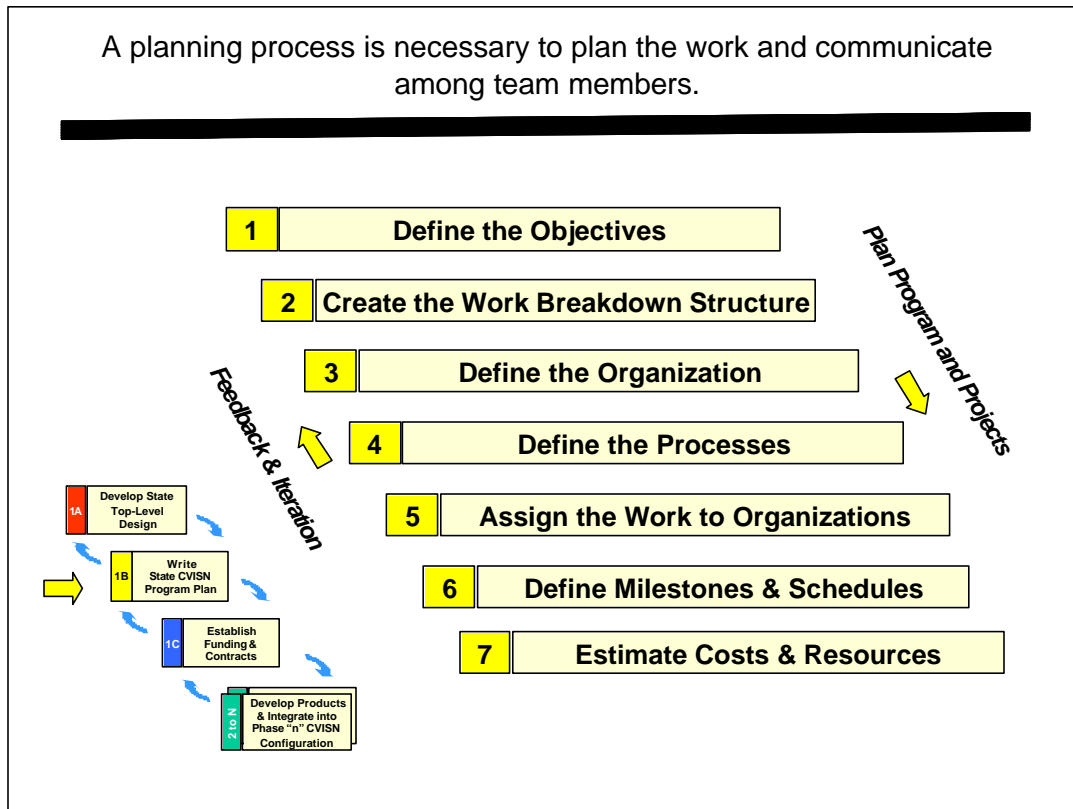

A planning process is necessary to plan the work and communicate among team members.

1 Define the Objectives
2 Create the Work Breakdown Structure
3 Define the Organization
4 Define the Processes
5 Assign the Work to Organizations
6 Define Milestones & Schedules
7 Estimate Costs & Resources

Plan Program and Projects

Feedback & Iteration

1A Develop State Top-Level Design
1B Write State CVISN Program Plan
1C Establish Funding & Contracts
2 to N Develop Products & Integrate into Phase "n" CVISN Configuration

Figure C–3. Project Planning Process

Planning Phase Products

·   A completed project plan that reflects the results of all the decisions made in this step. The top-level plan for credentials administration should be reflected in the State CVISN Project Plan.
·   Documents necessary to support acquisition of full project funding. The plan should support this, but other proposals and state-specific documents may be required.
·   Preliminary Phase Schedule for credentials administration systems and capabilities.

Factors to Consider in the Project Planning Phase

- What other projects are going on in your state that may impact the CVISN project. For several of the pilot states, Y2K efforts had such a high priority that resources were not available for CVISN tasks. Are there any major projects ongoing in your state that will compete for resources? Are major upgrades already taking place in the systems that support credentialing? Are major upgrades planned in the hardware and communications systems that will support the credentialing applications?
- If you are modifying existing systems in-house, will state staff be able to dedicate sufficient time to accomplish the modifications? Does this project have sufficient priority among all the on-going efforts? Does the management structure support the project?
- What policies does your state have on the use of the Web? Is there a program in your state to actively promote "electronic government" and deliver more services over the Web and the Internet? Can you leverage on these programs?
- What type of internal methodology has your state used in the past for information system development in the credentialing area? Is the process outlined in the CVISN guide series compatible with that approach? Are there any special requirements for feasibility studies or cost/benefit analysis studies?
- What is the typical procurement cycle in your state? What steps are required? How long does it take? What can be done to expedite this?
- What have other nearby states done towards implementing CVISN? Can you leverage what they have done, learn from them or partner with them in some way?

Key Decisions

- Should the state build or buy each subsystem?
- Will the state update current legacy systems or re-compete/re-develop?
- Will the state sponsor the development and deployment of a CAT? Who will provide CATs to early-adopter carriers?
- When will the state join each clearinghouse?
- Will the state participate in the Performance and Registration Information Systems Management (PRISM) program?
- What are the priorities and sequence for implementing capabilities?
- Who is the system integrator?
- Should the state have an independent verification and validation (V&V) agent?
- Sole Source or Competitive Contracting?
- Has the state planned to involve its carriers at each step in the planning process?
- Could other state or local agencies use the CVO data?

Advice and Lessons Learned

- If you are going to implement a computer-to-computer interface, your state should support the development (or modification) of at least one or two CAT or fleet management packages to interface to your state CI. Forcing carriers to pay for the development of a CAT capability to an undemonstrated state interface is asking a lot. Your program is likely to expand faster if you select a few carriers to test out a state-sponsored CAT capability. Ideally, CAT's (or equivalent fleet management products) would be used from two different vendors to provide choice and promote competitive pricing.
- If you are using X12 EDI, you need to test that your state has a working EDI interface to the state system(s), e.g., the CI, that are handling EDI credentials transactions.
- If you are implementing a CAT, the state should establish testing requirements and a test environment so that motor carriers and their software vendors can develop CAT packages on their own and easily test that they interfaced correctly with state systems. If you are implementing a Web site, testing is important as well and should be considered part of your CVISN program. Johns Hopkins University/Applied Physics Laboratory (JHU/APL) has developed a series of standardized interoperability tests and a CVISN Test Facility that can help. (Please see the *CVISN Guide to Integration and Test*, Reference 50.)

C.4   Funding and Contracts Phase

Funding and Contracts Phase Process

The CVISN Guide to Project Planning describes the general process for the funding and contracting phase. Figure C-4, which portrays this process, is repeated below as a reminder. The process for this phase is very dependent on state specific details. The figure is intended to give a conceptual framework and starting point. You should develop a specific process that meets the needs of your state.
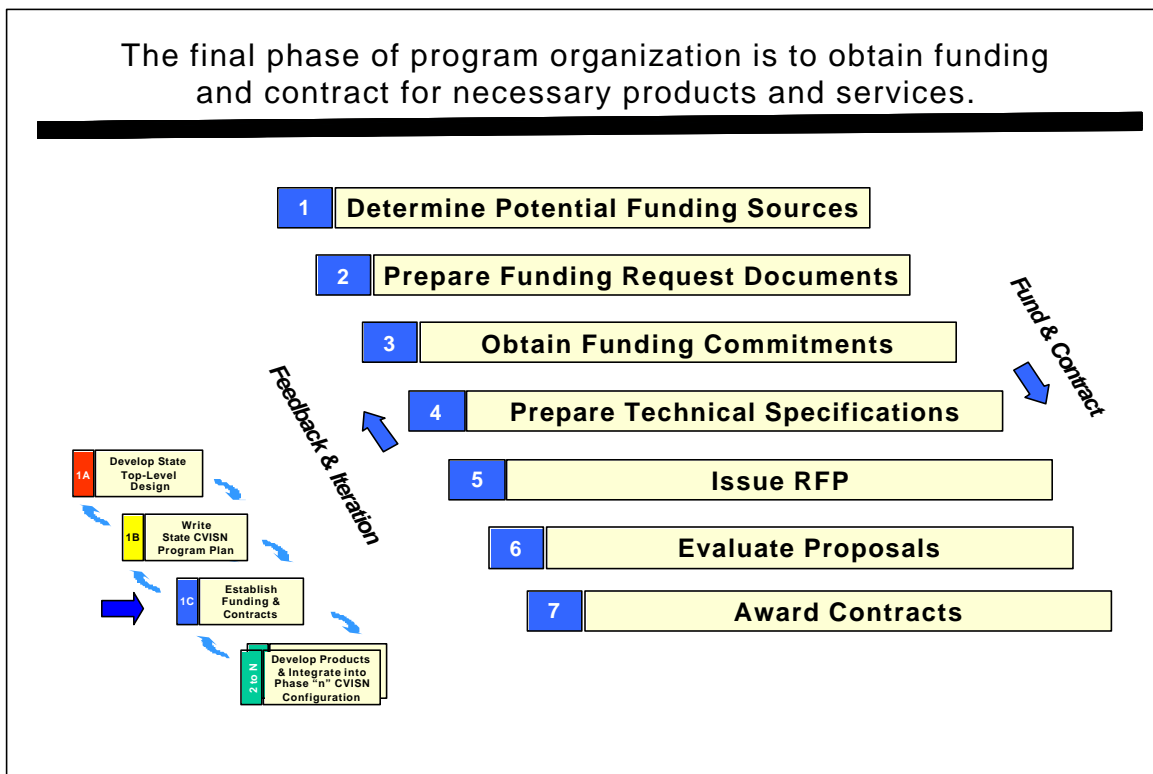
Figure C–4. Funding and Contracts Phase Process

Funding and Contracts Phase Products

- Documents needed (PR material, feasibility studies, cost/benefit studies, grant applications or proposals) to obtain funding
- Commitments for funding from state, federal and private sources on a schedule that meets project cash flow requirements.

- Procurement documents (e.g., request for proposal (RFP), evaluation plan, feasibility study, and sole source justification) to acquire hardware and software products as well as software development, system integration, communication, and verification and validation services.
- Flexible contract mechanisms are in place to support a team of contractors as required to complete all aspects of the project.

Factors to Consider in the Funding and Contracts Phase

- The credentials administration area is particularly complex. It is too complex to form an iron-clad specification of just how everything is going to work prior to issuing contracts. The state needs contractual vehicles that allow work to be defined and costs estimated at a high level before all the details are known. The contractual mechanism must also have the flexibility to define detailed process and system design as the work proceeds.
- Be sure to include measurements of performance and remedies for non-performance in contracts.
- Be sure to account for operations and maintenance in the budget estimates.
- *If the state is pursuing a mostly custom development approach:* The requirements analysis approach is critical. The requirements will guide the activities of the contractors. Consider including a proof-of-concept phase in which the state can judge the contractor's commitment and ability to meet the technical and schedule requirements.
- *If the state is using mostly commercial-off-the-shelf (COTS) packages:* The requirements analysis approach is required, but not as critical as with custom development. Basically, you are buying what vendors already have. You want an opportunity to "try before you buy". Consider including a preliminary demonstration phase in your contract that allows your state personnel to see the basic (unmodified) package they are getting before making the final commitment to it.

Key Decisions

- How much funding is required to complete the project?
- Where will the funding be obtained?
- What type of procurement should be used for each product or service?
- What can be done to expedite procurements?
- What type of incentives and remedial mechanisms should be included in the contracts?
- What terms and conditions related to software rights should be included in the contracts?
- How can the RFPs be written to assure architectural conformance and interoperability?

Advice and Lessons Learned

- If possible, set up some type of indefinite delivery/indefinite quantity (ID/IQ) contract vehicle with your systems integration agent and software services vendors. This allows you to define specific task orders as the work proceeds. It lessens the need to have a "frozen" set of requirements up front. It allows the team a lot more flexibility in solving problems. It allows adapting to changes in technology as the project proceeds.
- To assure architecture conformance, be sure to require that vendors prove that their deliverables conform to the architecture through the execution and analysis of interoperability tests. Also require design reviews so that the state's Conformance Assessment Team can check the design for conformance.
- When states decide to do a mostly COTS approach, they expect the costs to be very small. This expectation is often not met. For example, if your state purchases an existing CI, it is likely to require substantial modification and customization to fit in your environment. It may need custom legacy system interfaces. Your state may have slightly different processes than other states using the product. You may require additional data fields. The result is that the COTS product may still cost hundreds of thousands of dollars. Nevertheless, it is still cost effective because a development from scratch may cost millions of dollars.

C.5   Development Phase "n"

Development Phase "n" Process

The *CVISN Guide to Phase Planning and Tracking* describes the general process for developing and maintaining a Phase Plan and tracking progress as the phase proceeds. Figure C–5, which portrays this process, is repeated below as a reminder.
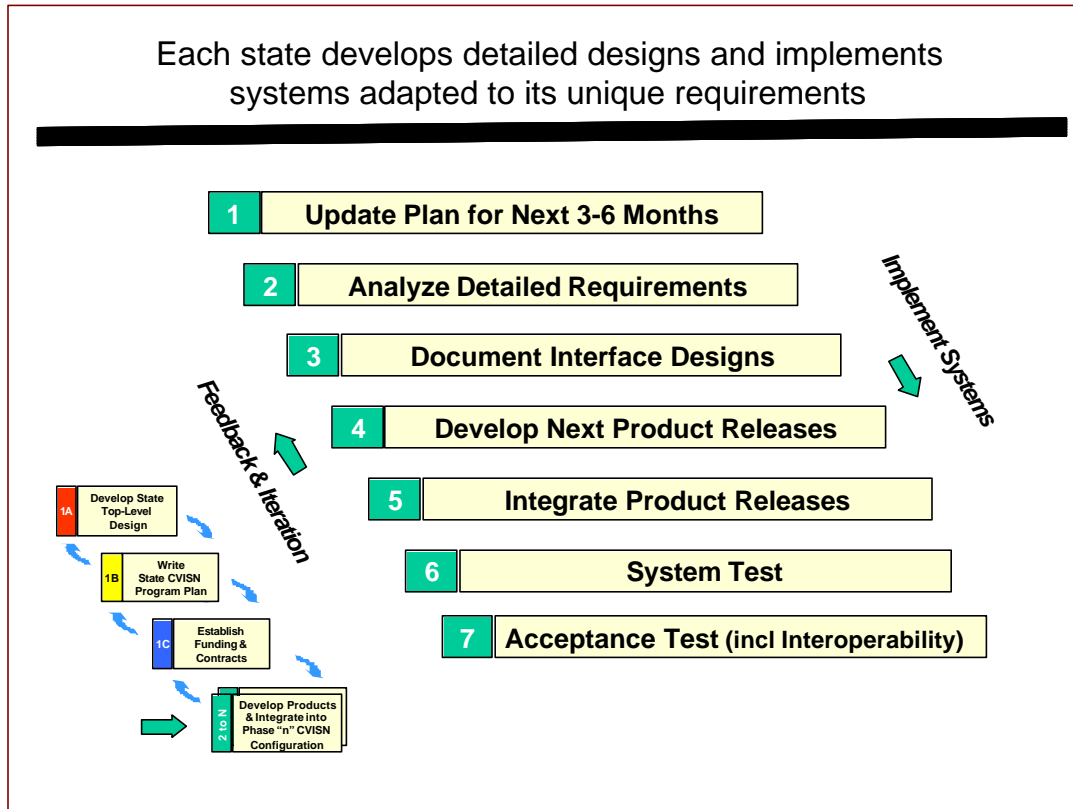
Figure C-5. Development Phase "n" Process

Development Phase "n" Products

- Working products (e.g., CATs, CI, LSIs, legacy modifications (LMs), Web site)
- Products integrated into the operational environment
- Test documentation showing proof that products worked as required
- Operation and maintenance documentation
- Net result: New operational capabilities

Factors to Consider in Development Phase "n"

- You need to be able to incrementally define details. Allow time in the schedule to define more scenarios and to document the state specific interface requirements at the beginning of each phase. If you are implementing X12 EDI, the state-specific EDI requirements should be published in a *State of ___ Motor Carrier Electronic Credentialing EDI Interface Control Document* that is made available on a state Web site.
- As components are developed, tests should be executed to verify that the components meet the design. As components are integrated, interoperability tests should be

executed to verify that the standard interfaces were implemented correctly, and that the components and products work together correctly.

- Configuration management becomes very important when integrating products from multiple vendors. A change management process must be in place. As changes are made to interface designs, everyone must be kept informed of changes and planned updates. Updates to systems on each end of the interface must be synchronized. Version numbers must be systematically assigned to all products and version description documents prepared to coordinate updates and make sure that compatible versions are installed together.

Key Decisions

- How should the initial design be modified based on the experience gained in each phase?
- How should the initial phase plan be modified based on progress actually made in each phase?

Advice and Lessons Learned

- Incremental deliveries reduce the risk for both the state and the vendor. Use them.
- Assuming that you are doing incremental development, allow time at the beginning of each phase for a "mini-business process reengineering (BPR)" study of just the processes for that phase. For example, maybe the next step focuses on the "IRP Add Vehicle" supplemental transaction. Allow a few days to define detailed processes. Also, refine the interface specifications at this time. Finalize any state specific details related to EDI interface maps (the software that converts legacy system data from or to EDI) at this time. This "just-in-time" analysis will present topics to the development team when they are ready to handle them and need the results. It will avoid "warehousing" a thick specification on a shelf to gather dust.
- An early delivery that shows tangible progress is critical to building the team, establishing forward momentum, establishing credibility, and securing funding. For example, Maryland established an electronic credentialing capability with several carriers with early versions of the CAT and CI. This was done even before the CI was interfaced to the state's processing systems. This allowed the carriers to try out the electronic credentialing concept. The state still needed to print out the application from the CI and retype it into their legacy system. Nevertheless, this was a good first step because it established the most critical interface, that between the carrier and the state.
- Schedule management is especially important in the credentials administration area because of the need to coordinate multiple vendors. The state needs an integrated schedule that has top level milestones and any external dependencies among the various vendors and organizations involved. The system architect needs to have clear authority to adjust the schedule details in response to technical issues. However, everyone must make a firm commitment to meet major milestones.

- The credentialing area will probably require close coordination among a number of vendors. Vendors will be dependent on each other for achieving their goals. These external dependencies need to be identified and carefully managed. When problems come up (as they always will, even in the best programs) there will be a tendency for everyone to blame the problem on someone else. You need a strong system integrator and problem resolution process to deal with this.
- An early indicator of a vendor's ability to perform is to check the level of effort being applied. There is no substitute for a visit to the vendor's development facility. Ask to meet the people working on your system. Ask what other assignments they are working on. Step back and perform a "sanity check" on staffing levels. Ask yourself if it is realistic to expect the work you want with the effort that is being applied.
- Hopefully, careful planning will allow things to go well with your vendors. But be sure to have contractual remedies in place just in case they don't. These can include progress payments based on performance, incremental funding, and cancellation clauses.
- Test data can be time consuming to prepare. Build on existing test data (e.g., the CVISN interoperability test suite package) when possible. Lack of test data can cause insufficient test and allow problems to go undetected until systems are put into production.
- Changes in requirements can kill project schedules and cause cost overruns. An effective configuration management (CM) process is necessary to ensure that changes are only made when the impacts on cost and schedule are understood and approved. For more information about CM, please see Reference 47.

C.6   Requirements Specification

Development of accurate requirements specifications that are detailed enough (but not too detailed) is a critical success factor in a credentials administration project. It is discussed here as a separate topic because it is a consideration that has impact on all phases of the development process, from top-level design through final acceptance testing. Several alternatives to specifying requirements are discussed below.

Alternative A: Simplified Requirements Specification Document.

If your state is not experienced in using detailed requirements specifications effectively, a simplified approach may be a better choice. Consider not writing a very detailed credentials administration requirements specification up-front.   Some folks think that a thick, detailed requirements document will ensure that the contractor will produce what you want. Experience has shown that this is not necessarily the case. Instead, a concise requirements document that states the end results and leaves the details to be developed as part of the phased development process is more likely to succeed. Remember that your objective is to produce a top-level requirements specification that limits the project scope and is concise, testable, and provides a basis for establishing and managing a contract.

One suggested approach is to use your *State CVISN Top Level Design Description* as the basic source of requirements for your credentials administration subsystems. The design description should include the completed sections of the various parts of the COACH:

- · COACH Part 1, Operational Concept and Top-Level Design Checklists
- · COACH Part 3, Detailed System Checklists
- · COACH Part 4, Interface Specification Checklists

Review and edit these, filling them out and customizing them as required to meet the needs of your state.

Your request for proposal (RFP) should refer to specific sections of the design description relevant to the item or items being procured. It can also reference these guides and any other state specific documentation (e.g., strategic plans) that provide background or describe your concept of operations. The RFP should require that the product pass the interoperability tests. Please see the COACH Part 5 (Reference 6) and the CVISN Interoperability Test Suite Package (References 26-28) for further information. The RFP should require that as part of the project, the vendor perform systems analysis and develop more detailed process descriptions and related requirements with operations personnel during each phase of the project. These process descriptions may be done in joint application design sessions using participant flows or some equivalent method and diagramming technique. When evaluating proposals, pay particular attention to the vendors' experience and proposed approaches to working with your team to develop these detailed process designs.

Alternative B: Delta Requirements

If your state is using a largely COTS approach, you may want to consider a variation on Alternative A. Do the simplified requirements specification based on your State System Design Description and COACH as described above. Then ask the contractor to install their COTS products for a trial period of 1-3 months. During this time, ask the contractor to develop a "delta" (i.e., difference) requirements specification that just describes what changes you want to make to their product. The contractor may use checklists, focus groups, interviews and other techniques to collect these delta requirements.

Preparation of the delta requirements is in lieu of a detailed description of each scenario or business process. If you are basically satisfied with the process as it exists, there is no need to spend a lot of effort documenting it.

Alternative C: Comprehensive Requirements Specification Document

Traditional software life cycle models advise having comprehensive, detailed, requirements nailed down in a requirements specification before the project starts. We have noted some problems with this approach, including:

- Developing the document is costly and time consuming
- Processes change and the document quickly becomes obsolete
- If the people developing the document aren't the ones developing the system, much of the investment remains locked in the heads of the analysts who wrote the specs and is not transferred to the developers. The developers will likely want to redo this work themselves and get the users' perspective first hand.
- User personnel often don't have time to invest in really studying requirements documents and making sure the documents reflect their needs
- It is very difficult for even the most dedicated user personnel to review the documents and actually understand what they are getting. When they finally see the system, they will realize that there were lots of things they wanted that didn't occur to them when reviewing the specs.

However, if your state has worked successfully with comprehensive, detailed requirements specifications before and this is what you want on this project, consider issuing a partial draft of the requirements specification as part of your RFP. Then have the successful bidder complete the draft as you require as part of their contract. Have them finalize sections with each phase of the project as it proceeds.

In Maryland and Virginia, comprehensive *Credentials Administration Requirements Specifications (CARS)* (References 48 and 49) were prepared up front. These documents provided a description of how transactions flow end-to-end through all the systems supporting credentials administration. They also allocated requirements to each subsystem, legacy system interface and legacy modification and defined interfaces between those elements. Because the prototype states were the first to initiate the credentialing project, it was felt that a comprehensive document like the CARS was needed. In retrospect, the CARS documents provided a wealth of information and were useful to the projects. In particular, the participant flows (in CARS Chapter 3, Business Processes) were very useful for gaining an understanding of how the users wanted the final system to work. However, the more technical sections of the CARS (Chapter 4, Systems Business Processes and Chapter 5, System Functional Requirements) were less useful and are not recommended for future efforts because of the time and cost of preparation.